# PHOENIX FIRE CODE SUMMARY

## Fuel Storage for Diesel Fire Pump Drivers

**REFERENCE FIRE CODE SECTION** 1997 Uniform Fire Code, Article 10, and NFPA 20, Installation of Centrifugal Fire Pumps, 1996 edition as adopted and amended by the City of Phoenix.

**SCOPE** An explanation of the requirements for the design, installation and maintenance of fuel storage systems for diesel fire pump drivers.

## SUMMARY OF HAZARDS

A concern of the Fire Department is that any flammable or combustible liquid fuel storage tank and its piping is liquid tight. In the case of fire pumps, a liquid tight system helps ensure that the pump driver will operate when required. A liquid tight storage and piping system also prevents the release of a fuel that could be ignited by a hot diesel engine. If a leak and fire occurs, a properly designed fuel system ensures that the storage tank is protected from a pressure explosion.

## COMMONLY USED HAZARDOUS MATERIALS AND THEIR CLASSIFICATION

Diesel fuel is the fuel used to power diesel pump drivers. Diesel fuel is assigned Chemical Abstract Service (CAS) Number 68334-30-5 and is classified as a Class II Combustible Liquid. Diesel fuel has the following NFPA 704 hazard ratings: Health: 1, Flammability: 2, Reactivity: 0, Special Hazards: Blank.

## SUMMARY OF FIRE CODE REQUIREMENTS

1. **Phoenix Fire Code Regulation R1003-2.1.** The regulation requires that a source of emergency power be provided for fire pumps. It offers three options:

   1.1. Use a listed electric fire pump that is connected to a standby power system such as a diesel driven generator,

   1.2. Use a listed electric fire pump that is connected to two independent utility power grids serving the property from two or more isolated locations, or

   1.3. Use an approved diesel driven fire pump.

2. **Phoenix Fire Code Requirements.** Article 79 of the Phoenix Fire Code has requirements for the storage and handling of Class II Combustible Liquids. The following summarizes the requirements for the construction and installation of the fuel tank and piping system.

   2.1. **Fuel Storage Tank - Construction**

      2.1.1. The tank shall be bear a permanent nameplate or marking indicating the standard used as a basis for design. At a minimum, atmospheric storage tanks shall be labeled as being constructed using Underwriters Laboratories 142, Standard for the Construction for Steel Flammable & Combustible Liquid Storage Tanks. (PFC 7902.1.8.2.1)

      2.1.2. Tanks constructed with integral secondary containment shall be listed as meeting UL 142. (PFC 7902.1.8.2.1)

      2.1.3. The tank nameplate shall state the required flow rate for the emergency vent. If a tank is constructed with integral secondary containment, the nameplate shall indicate the required flow rate for the primary and secondary containment tank. (UL 142, Section 48.1).

**2.2. Fuel Storage Tank – Secondary Containment**

2.2.1. Secondary containment is required when the tank volume is more than 240 gallons inside a single control area of a sprinklered building or 120 gallons inside a single control area of a non-sprinklered building.

2.2.2. Secondary containment is required when a stationary aboveground storage tank is installed outside of a building.

**2.3. Fuel Storage Tank – Normal Vent**

2.3.1. The tank normal vent shall be terminated outside of the building. Regardless of the tank's location, the vent shall be terminated at least 12 feet above grade, 5 feet from property lines and 5 feet from building openings. (PFC 7902.1.11.4)

2.3.2. Normal vents shall be installed so they will drain toward the tank without traps in which liquids can collect. The normal vent shall not be subject to physical damage or vibration.

2.3.3. The minimum required diameter of a normal vent is 1 ¼ -inch. (PFC 7902.1.11.7)

**2.4. Fuel Storage Tank – Emergency Vent**

2.4.1. An emergency vent shall be provided for the primary tank and, when provided, the secondary containment tank. (PFC 7902.2.6.1)

2.4.2. Emergency vents shall be the commercially produced type that is stamped at the factory to indicate its flow rate and opening pressure.

*(NOTE: The tank manufacturer can fabricate emergency vents specifically designed for the each model of tank fabricated. The PFC requirements for these emergency vents are fairly detailed and have extensive testing requirements. See PFC 7902.2.6.4.2)*

2.4.3. The flow rate of the emergency vent shall at equal or exceed the flow rate specified on the tank nameplate. (PFC 7902.2.6.3.2)

2.4.4. In instances where the tank manufacturer desires to use the flow rate of the normal and the emergency vent to satisfy the minimum emergency vent flow rate, the normal vent shall be stamped to indicate its flow rate. (PFC 7902.2.6.3.1)

**2.5. Fuel Storage Tank – Tank Openings Other Than Vents**

2.5.1. Tank fill connections shall be located outside of buildings. (PFC 7902.1.13.1.1)

2.5.2. For tanks inside of buildings, the tank fill openings shall be located not less than 10 feet from building openings or lines of property that can be built upon. (PFC 7902.1.13.1.1)

2.5.3. For top-loaded tanks, a metallic fill pipe fill pipe shall be installed to minimize the generation of static electricity by terminating the pipe within 6-inches of the bottom of the tank, and shall be installed in such a manner that avoids excessive vibration. (PFC 7902.1.13.1.1)

2.5.4. Tanks installed inside of buildings shall be equipped with a device or other means to prevent the overflow of liquid into the building. Suitable means include a float valve, a

preset meter on the fill line, a valve actuated by the weight of the tank contents, etc. (PFC 7902.1.13.1.4)

2.5.5. Tanks installed outside of buildings that have a volume of 500 gallons or more shall be equipped with a positive means of overfill protection. (PFC 8003.1.5)

2.5.6. The gauging openings for tanks inside of buildings shall be protected against liquid overflow and possible vapor release by means of a spring-loaded check valve or other approved device. (PFC 7902.1.13.1.6)

**2.6. Fuel Storage Tank – Support Columns**

2.6.1. Tanks elevated more than 12 inches above finished floor require fire protection for the supports. If the pump room is sprinklered, no additional fire protection is required, unless the tank diameter is over 48-inches. (PFC 7902.1.14.4, exception 3)

2.6.2. If the fuel tank is located outside the building and is elevated more than 12 inches above grade, fire protection for the columns is required. When fire resistive assemblies are used, they shall meet ASTM E-1529, Standard Test Method for Determining Effects of Large Hydrocarbon Pool Fire on Structural Members and Assemblies. (PFC 7902.1.14.4)

*(NOTE: PFD will accept listed assemblies that meet UL 1709, Rapid Rise Fire Test. Note that all of the UL listed assemblies researched by the Fire Department require that the support columns have a density of about 50 lbs./ft., which equates to 8-inch diameter pipe with a ¼-inch wall thickness.)*

**2.7. Fuel Piping**

2.7.1. Thermoplastic piping is prohibited. (PFC 7901.11.1.1 and ASME B31.3, Process Piping, Section A323.4.2)

2.7.2. Pipe joints that are dependant on the friction characteristics for liquid tightness of piping shall not be used in buildings. (PFC 7901.11.8)

2.7.3. Low-melt point metallic materials and fittings may be used when the operating pressure of the system is within the temperature and pressure limitations of the selected material. (PFC 7901.11.1.2)

2.7.4. When low-melt point metallic piping is used, the piping shall be protected by automatic sprinkler protection. (PFC 7901.11.1.2)

2.7.5. When threaded carbon steel pipe are fittings are used, the pipe thread sealant shall be approved for flammable liquid service. (PFC 7901.11.8).

2.7.6. A guard or protective pipe shall be provided for all fuel lines. (NFPA 20, Section 8-4.2)

2.7.7. Flame-resistant flexible hoses listed for diesel fuel service shall be provided at the engine for connection to the fuel system. (NFPA 20, Section 8-4.6)

2.7.8. There shall be no shutoff valve in the fuel return line to the tank. (NFPA 20, Section 8-4.6)

2.7.9. Prior to introducing fuel into the piping system, the pipe and fittings shall be pneumatically or hydrostatically tested. If pneumatically tested, the test pressure shall be 1.1X the design pressure of the system. If hydrostatically tested, the test pressure shall be 1.5X the design pressure of the system. The minimum test duration is 10 minutes. (PFC 7901.11.10)

**2.8. Other PFC Requirements**

2.8.1. The tank cannot be filled or placed in service until it is inspected and approved by the Phoenix Fire Department **AND** the owner has obtained a Flammable/Combustible Liquids Storage, Handling and Use permit.

2.8.2. When a fire pump is equipped with a hose valve test header, a "DO NOT PUMP INTO THESE CONNECTIONS" sign shall be located above or adjacent to the test connection. This sign shall meet the PFD sign specification. (PFC 901.4)

2.8.3. The tank shall be labeled to indicate its contents. (PFC 7901.9.1)

**3. NFPA 20 Requirements**

**3.1. Fuel Tank – Design**

3.1.1. The tank shall be designed to contain a minimum volume of fuel. The minimum volume shall equal 1 gallon of fuel for each 1 horsepower of the driver rating, plus a 5% volume for the sump and 5% volume for expansion. (NFPA 20, Section 8-4.5)

3.1.2. Means other than sight tubes shall be provided for determining the amount of fuel in the storage tank. (NFPA 20, Section 8-4.5)

3.1.3. A separate fuel tank and fuel supply and return piping shall be provided for each engine. (NFPA 20, Section 8-4.4)

**3.2. Fuel Tank – Installation Requirements**

3.2.1. The inlet to the fuel supply line shall be located so that its opening is no lower than the level of the engine fuel transfer pump. (NFPA 20, Section 8-4.5)

3.2.2. If an electric solenoid valve is used to control the fuel supply to the engine, the valve shall be designed so that is capable of manual mechanical operation or it can be manually bypassed in the event of a control circuit failure.

## REQUIRED FIRE CODE PERMITS

The following permits are required for fuel storage tanks that supply diesel fire pump drivers:

- A PFD construction permit is required before installing an aboveground storage tank. Before this permit can be issued, a minimum of two sets of tank shop drawings shall be submitted to the Fire Department for review and approval. The plan review fee is $200 and the permit fee for one tank is $450.00. This permit is separate from the construction permit for the automatic sprinkler system. (PFC 105.8 and NFPA 20 Section 8-4.3)
- The building owner or tenant is required to obtain a Flammable/Combustible Liquids Storage, Handling and Use permit. The permit application and Hazardous Materials Inventory Statement is available at Fire Department Headquarters, Fire Prevention Division located at 150 S. 12th Street.

The permit application and fee schedule is also available on-line at www.phoenix.gov/fire/ and click on “Permits and Inspections.” (PFC 105.8, permit f.3)

## OTHER REQUIRED CITY OF PHOENIX PERMITS

Buildings housing fire pumps are required to meet the requirements of the Phoenix Building Code. This includes dedicated “pump houses” or rooms that house fire pumps.

The construction of the room or building will be required to meet the applicable Building, Mechanical, Electrical and Plumbing Code requirements.

An important consideration is the amount of diesel fuel stored inside the room or building. The maximum allowable quantity of **diesel fuel AND OTHER CLASS II COMBUSTIBLE LIQUIDS** inside a single control area of a building is 240 gallons. If this quantity limit is exceeded in one control area, the Building Official will classify the pump room as a Group H-3 occupancy. The following additional fire and building code requirements will be applied:

- A copy of the Phoenix Fire Department for the Flammable/Combustible Liquids Storage, Handling and Use permit application and the Hazardous Materials Inventory Statement.
- Secondary containment designed to contain the largest container or tank + 20 minutes of sprinkler water flow.
- Depending on the area of the pump room, either a one- or two-hour fire-resistive wall assembly is required if the fire pump and fuel storage tank is located inside a mixed occupancy building.
- If the area of the pump room if its area is more than 200 Ft.$^2$, panic hardware is required on the exit door(s).
- If the room travel distance is more than 75 feet, two exits are required.
- The fuel storage tank may be located in a basement or on a floor abovegrade. The height or story that the tank may be located abovegrade depends on the construction type and occupancy classification.
- Mechanical ventilation designed to exhaust the room at minimum airflow rate of 1 CFM/Ft.$^2$ is provided for the pump room.

The building permit fee is calculated using the value of the building or area. To obtain an accurate fee calculation, contact the Development Services Department Business Customer Service Center at 602-534-2000.

## HOW CAN I OBTAIN MORE INFORMATION?

If this fire code summary does not answer your questions, please feel free to contact one of the Phoenix Fire Department’s fire protection engineers or fire plan examiners at 602-262-6771. E-mail inquires can be sent to phoenix.fire.prevention@phoenix.gov

Requests for information about Building, Plumbing, Mechanical and Electrical Code requirements should be directed to the Development Services Department at 602-534-2000.

Telephony or e-mail messages regarding particular code requirements to the Phoenix Fire Department are not official interpretations. An official interpretation requires a plan review or written correspondence that requests an official interpretation, the referenced code section(s) **AND** includes sufficient information to interpret if the applicable code section(s) applies.

## PREPARED BY

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Revisions:

H://sstookey/firecodesummary/diesel tank for fire pumps.doc